AMENDMENTS TO THE CLAIMS

This listing of claims replaces all prior versions, and listings, of claims in the application.

1. (Previously Presented) An underwater power distribution system for powering a plurality of devices comprising:

an underwater cable, the devices being disposed along the underwater cable;

a main power line extending through the underwater cable;

a plurality of power distribution lines;

a plurality of power distributors, each being electrically coupled between the main power line and one of the power distribution lines to transfer power from the main power line to the power distribution line; and

a plurality of power couplers disposed at selected locations along the underwater cable, each power distribution line being coupled to one or more power couplers and each power coupler being disposed proximate one of the devices for coupling power to the proximate device.

2. (Previously Presented) An underwater power distribution system for powering a plurality of devices comprising:

an underwater cable including a plurality of cable segments, at least one of the devices being disposed along each cable segment, and a plurality of streamer electronics modules alternately arranged with the cable segments and spaced from the devices;

a main power line extending through the underwater cable;

a plurality of power distribution lines, at least one power distribution line extending through each cable segment and each streamer electronics module including a circuit for coupling electric power from the main power line to an adjacent power distribution line; and

a plurality of power couplers disposed at selected locations along the underwater cable, each power distribution line being coupled to one or more power couplers and each power coupler being disposed proximate one of the devices for coupling power to the proximate device.

3. (Currently Amended) A method for distributing power underwater comprising:

transmitting power at a first frequency on a main power line of an underwater cable;

converting the power on the main power line to a second frequency, higher than the first frequency; and

distributing the power at the second frequency on a plurality of power distribution lines within the underwater cable to a plurality of devices selectively disposed along the underwater cable.

4. (Currently Amended) The method of claim 3 wherein transmitting power at the first frequency ~~is~~includes transmitting power at a DC frequency of zero.

5. (Currently Amended) An underwater power distribution system for powering a plurality of devices comprising:

an underwater cable, the devices being disposed along the underwater cable;

a main power line extending through the underwater cable and arranged to transmit a main power signal at a first frequency; and

a plurality of conversion circuits disposed at spaced locations along the underwater cable and respectively coupled between the main power line and the plurality of devices, each conversion circuit being positioned within the underwater cable and arranged to convert the main power signal into a power distribution signal at a second frequency higher than the first frequency.

6. (Previously Presented) The underwater cable of claim 5 wherein the each conversion circuit is arranged to convert the main power signal into a DC signal and then to convert the DC signal into the power distribution signal.

7. (Currently Amended) An underwater system for transferring power comprising:

a plurality of wet units, each having a first inductor for receiving power;

an underwater cable having the plurality of wet units selectively spaced therealong and including a plurality of second inductors respectively disposed adjacent to the first inductors in the wet units;

a plurality of hydrophones disposed along the underwater cable and having one or more first operating frequency bands; and

a plurality of power conversion circuits positioned within the underwater cable and respectively coupled to one or more of the second inductors to output a signal having a second operating frequency band to the wet units, wherein the first operating frequency bands and the second operating frequency band do not overlap.

8. (Previously Presented) The underwater system of claim 7 including a plurality of power distribution lines extending along the underwater cable, each power distribution line being coupled between one of the power conversion circuits and associated one or more second inductors and being arranged to transmit power to the second inductors, wherein the power distribution lines include lumped and distributed parameters and wherein the lumped and distributed parameters of each power distribution line form a distributed bandpass filter centered about the second operating frequency band.

9. (Previously Presented) A method of transferring power underwater comprising:

having a plurality of hydrophones in an underwater cable which operate at one or more first frequency bands; and

transferring power inductively from an underwater cable to a plurality of wet units using a second frequency band which does not overlap the one or more first frequency bands.

10. (Previously Presented) An underwater power distribution system for a plurality of devices comprising:

an underwater cable having an outer sheath and being filled with a lossy dielectric material having a dissipation factor of about 0.01 or greater, the devices being disposed along the underwater cable;

a main power line extending through the underwater cable; and

a plurality of insulated twisted pair transmission wires extending through the underwater cable and coupled between the main power line and the devices, each twisted pair transmission wire having an outer sheath and a dissipation factor of less than about 0.01, when surrounded by the lossy dielectric material.

11. (Previously Presented) An underwater coupling system comprising:

an underwater cable;

at least one coupler disposed in the underwater cable; and

a plurality of inductive coils selectively disposed outside the underwater cable at circumferentially spaced locations about the coupler.

12. (Previously Presented) An underwater coupling system comprising:

an underwater cable;

at least one coupler disposed in the underwater cable; and

a plurality of inductive coils circumferentially spaced inside the coupler.

13. (Previously Presented) An underwater coupling system comprising:

an underwater cable; and

a plurality of inductive couplers disposed at selected locations along the underwater cable, each coupler including one or more coils having a core having a substantially triangular-shaped cross section and a winding wound around the substantially triangular-shaped core.

14. (Previously Presented) An underwater coupling system comprising:

an underwater cable;

first and second lines extending through the underwater cable; and

a plurality of couplers disposed at selected locations along the underwater cable, each coupler including a first coil connected to the first line and second and third coils connected to the second line, wherein the first and second coils are spaced from each other and the first and third coil are in close proximity for controlling cross-talk between the first and second coils.

15. (Previously Presented) An underwater coupling system comprising:

an underwater cable;

first and second lines, extending through the underwater cable; and

a plurality of couplers disposed at selected locations along the underwater cable, each coupler including an integral core having first and second portions and first and second coils respectively wound around the first and second portions of the integral core, the first and

second lines being respectively connected to the first and second coils.

16. (Previously Presented) An underwater communication system for communicating with a plurality of devices comprising:

an underwater cable, the devices being disposed along the cable;

a plurality of data distribution lines extending through portions of the underwater cable, each data distribution line being coupled to one or more devices and being tuned to resonate at a first frequency with a predetermined bandwidth;

a plurality of repeater circuits coupled between adjacent data distribution lines to form a data communication channel; and

a plurality of load adjusting circuits respectively associated with the data distribution lines to maintain each data distribution line tuned to about the first frequency with the predetermined bandwidth in response to a failure mode.

17. (Previously Presented) The underwater communication system of claim 16 wherein at least one of the load adjusting circuits includes first and second Zener diodes oppositely connected in series.

18. (Previously Presented) An underwater data communications system for communicating with a plurality of electrical devices comprising:

a primary data communications circuit;

a backup data communications circuit;

circuitry coupled to the primary data communications circuit and the backup data communications circuit to switch between the primary data communications circuit and the secondary data communications circuit in response to a loss of power to the electrical devices.

19. (Previously Presented) An underwater power distribution system for powering a plurality of devices, each having one or more loads, comprising:

an underwater cable having the plurality of devices selectively spaced therealong;

a first line extending through the underwater cable and being coupled to the plurality of devices;

fault detection circuitry coupled to the first line to detect when a fault is present;

and

disabling circuitry coupled to the fault detection circuitry to disable one or more loads in a hierarchical order in response to a fault.

20. (Previously Presented) An underwater power distribution system for powering a plurality of devices, each having one or more loads, comprising:

an underwater cable having the plurality of devices selectively spaced therealong;

a power line extending through the underwater cable and being coupled to the plurality of devices;

a current limited driver circuit coupled to the power line to output a power signal having not more than a predetermined current level on the power line;

fault detection circuitry coupled to the power line and including a voltage detection circuit for detecting the voltage on the power line, whereby a fault may be indicated by a change in voltage on the power line.

21. (Previously Presented) A method of distributing power along an underwater transmission system comprising:

transferring electrical signals along an underwater cable having a plurality of devices spaced therealong, each device having one or more loads;

detecting a fault in the underwater transmission system;

removing loads along the underwater cable in a hierarchical order in response to the fault; and

powering the remaining loads.

22. (Previously Presented) A method for power distribution and communication along an underwater cable comprising:

transferring power and data along a line in an underwater cable having a plurality of spaced devices coupled thereto, each device including one or more electrical loads;

detecting a fault; and

selectively removing one or more of the electrical loads from the underwater cable according to a predetermined hierarchy in response to the fault.

23. (Previously Presented) An underwater electrical device for an underwater cable comprising:

a housing arranged to be attached along the underwater cable;

a load circuit disposed in the housing;

an inductor circuit coupled to the load circuit to transfer a power signal from the underwater cable to the load circuit, the load circuit loading the power signal; and

a control circuit coupled to at least one of the inductor circuit and the load circuit to reduce the loading in response to a power level of the power signal falling below a predetermined value.

24. (Previously Presented) An underwater electrical device for an underwater cable which includes a line having a voltage, the underwater electrical device comprising:

a housing arranged to be attached along the underwater cable;

at least one electrical load disposed in the housing; and

a control circuit disposed in the housing and including circuitry for monitoring the voltage on the line, the control circuit being coupled to the electrical load to reduce the load in response to the voltage falling below a predetermined value.

25. (Previously Presented) An underwater electrical device for an underwater cable comprising:

a controller circuit arranged to be coupled to and receive power from the underwater cable, the controller circuit including fault detection circuitry to detect a fault and load shedding circuitry to reduce the amount of power received from the underwater cable in a hierarchical order responsive to the fault.

26. (Previously Presented) An underwater communication system for communicating with a plurality of devices comprising:

an underwater cable having the devices selectively spaced therealong

an inbound data distribution line and an outbound data distribution line extending through the underwater cable and coupled to one or more of the devices;

at least one repeater circuit disposed in the underwater cable wherein the repeater circuit includes synchronization circuitry coupled to the inbound and outbound data distribution

lines to derive clock data from the outbound data and to transmit the inbound data in accordance with the derived clock data, whereby a timing relationship exists between inbound and outbound data.

27. (Currently Amended) A method of communicating data underwater comprising:

transmitting outbound data and inbound data through a repeater circuit in an underwater cable to or from devices selectively spaced along the underwater cable;

decoding the outbound data in the repeater circuit to recover clock data; and

transmitting inbound data from the repeater circuit in synchronism with the clock data.

28. (Previously Presented) An underwater electrical device for an underwater cable comprising:

a housing arranged to be attached along the underwater cable;

an input circuit disposed in the housing and arranged to input data from the underwater cable, the input circuit including synchronization circuitry to derive a timing signal from the data; and

an output circuit coupled to the input circuit and arranged to output data to the underwater cable in synchronism with the timing signal.

29. (Currently Amended) A method of communicating underwater comprising:

receiving outbound data for devices selectively spaced along an underwater cable;

decoding the outbound data to recover a data clock; and

transmitting inbound data from the devices along the underwater cable in synchronism with the data clock.

30. (Previously Presented) An underwater electrical device for an underwater cable comprising:

an inductor; and

a drive circuit coupled to the inductor to control a current flowing through the inductor responsive to an inbound data bit having a bit time, the drive circuit including a capacitor coupled to the inductor to form a resonant circuit having a resonant period of about

between 1/16 of the bit time and the bit time.

31. (Currently Amended) An underwater electrical device for an underwater cable comprising:

an inductor; and

a drive circuit including a plurality of driving transistors, a transformer coupled in parallel with the inductor, and a capacitor coupled in parallel with the transformer, wherein the primary and secondary of the transformer are coupled between the electrical device and the underwater cable.

32. (New) The method of claim 3 wherein transmitting power at the first frequency includes transmitting power at a frequency in the range from about 1kHz to about 4kHz.

33. (New) The method of claim 32 wherein converting the power to the second frequency includes converting the power to a frequency in the range from about 25kHz to about 400kHz.

34. (New) The method of claim 3 wherein converting the power to the second frequency includes converting the power to a frequency in the range from about 25kHz to about 400kHz.

35. (New) The method of claim 3 wherein converting power on the main power line comprises converting the main power line signal to a DC signal and converting the DC signal to the higher frequency power distribution signal.

36. (New) The method of claim 3 further comprising inductively coupling the higher frequency power distribution signal from the power distribution line across a sheath of the cable to the device.

37. (New) The method of claim 3 further comprising transmitting data along the power distribution lines.

38. (New) The method of claim 37 wherein transmitting data along the power distribution lines includes encoding data on the power distribution signal.

39. (New) The method of claim 38 wherein encoding data on the power distribution signal includes encoding outbound data on the power distribution signal.

40. (New) The system of claim 5 wherein each power conversion circuit is arranged to convert a DC main power signal to an AC power distribution signal having a frequency in the range from about 25kHz to about 400kHz.

41. (New) The system of claim 5 wherein each power conversion circuit is arranged to convert an AC main power signal having a frequency in the range from about 1kHz to about 4 kHz to an AC power distribution signal having a frequency in the range from about 25kHz to about 400kHz.

42. (New) The system of claim 5 further comprising a plurality of power distribution lines, each power distribution line being coupled to a power conversion circuit and arranged to transmit the power distribution signal.

43. (New) The system of claim 42 wherein first and second power distribution lines extend in opposite directions from a power conversion circuit along the underwater cable.

44. (New) The system of claim 42 wherein the underwater cable includes an outer sheath to which devices are attached, the power distribution system further comprising one or more couplers electrically connected to a power distribution line to inductively couple the power distribution signal through the sheath to the device.

45. (New) The system of claim 5 further comprising an encoding circuit coupled to a power conversion circuit to encode data on the power distribution signal.

46. (New) The system of claim 45 wherein the encoding circuit is arranged to encode outbound data on the power distribution signal.

47. (New) The system of claim 45 further comprising a power distribution line coupled to a conversion circuit and a driver coupled to the power distribution line to drive a power distribution signal having data and power along the power distribution line.

48. (New) The system of claim 5 further comprising a data channel extending along the cable and a plurality of hydrophones disposed along the cable, wherein the hydrophones transmit hydrophone data over the data channel.

49. (New) An underwater data communication system for communicating with a plurality of electrical devices comprising:

an underwater cable, the devices being disposed along the underwater cable;

a first data communications circuit disposed along the underwater cable;

a second data communications circuit disposed along the underwater cable wherein communications over the second data communications circuit is at a lower bit rate than over the first data communications circuit; and

circuitry coupled to the first data communications circuit and the second data communications circuit to switch between the first data communications circuit and the second data communications circuit.

50. (New) An underwater data communication system as in claim 49 wherein the circuitry coupled to the first data communications circuit and the second data communications circuit includes a switch.

51. (New) An underwater data communication system as in claim 49 wherein the circuitry coupled to the first data communications circuit and the second data communications circuit includes a microprocessor to switch between the first data communications circuit and the second data communications circuit.

52. (New) An underwater data communication system as in claim 49 further comprising a plurality of repeaters disposed along the cable, wherein the circuitry coupled to the first and second data communications circuits includes a plurality of switches disposed along the

cable each associated with a corresponding repeater, wherein the first data communications circuit includes the first data line segments connected between consecutive repeaters, wherein the second data communications circuit includes second data line segments connected between consecutive switches and coupled to the devices and wherein the switches connect the second data line segments to the repeaters in a first mode of operation and cause the second data line segments to bypass the repeaters in a second mode of operation.

53. (New) An underwater communication system as in claim 52 wherein the second mode of operation is characterized by a loss of power.

54. (New) An underwater communication system as in claim 52 further comprising a plurality of hydrophones disposed along the cable and link control circuits adapted to digitize signals from the hydrophones for transmission by the repeaters along the first data communications circuit.

55. (New) An underwater communication system as in claim 52 wherein the first data communications circuit includes a fiber optic cable.

56. (New) An underwater communication system as in claim 49 further comprising a plurality of repeaters disposed along the cable, the first data communications circuit including a first data line serially linking the repeaters along the cable, the second data communications circuit including a second data line extending along the cable and including couplers coupling the second data line to the devices, and the circuitry coupled to the first and second data communications circuits including a control circuit that switches the underwater communication system between a first communications mode in which the second data line links the repeaters serially and a second communications mode in which the second data line bypasses the repeaters along the cable.

57. (New) An underwater communication system as in claims 56 wherein the circuitry coupled to the first and second data communications circuits further includes a plurality of switches connected between the second data line and the repeaters and wherein the control circuit moves the switches from a first position connecting the second data line to the repeaters

in the first communications mode to a second position bypassing the repeaters in the second communications mode.

58. (New) An underwater communication system as in claim 56 wherein the first data line further comprises couplers coupling the first data line to the devices.

59. (New) An underwater communication system as in claim 56 wherein the first data line includes a fiber optic cable.

60. (New) An underwater communication system as in claim 56 wherein the first communications mode is the primary communications mode and the second communications mode is a backup communications mode.

61. (New) An underwater communication system as in claim 56 wherein the control circuit selects the second communications mode upon a loss of power to the repeater.

62. (New) An underwater communication system as in claim 56 wherein communications in the second communications mode is at a lower bit rate than in the first communications mode.